1054-94 QT-Dispersion Is Related to Sympathetic Tone After Acute Myocardial Infarction and In Chronic Heart Failure

C.E. Bonnar, R.J. MacFadyen, S.D. Pringle[1], A.D. Struthers. *Department of Clinical Pharmacology, Ninewells Hospital & Medical School, Dundee, Scotland, UK; [1]Department of Cardiology, Ninewells Hospital & Medical School, Dundee, Scotland, UK*

Background: In animal studies, sympathetic activation increases dispersion of ventricular depolarization. QT-dispersion (QTd) is increased in patients after acute myocardial infarction (AMI) and in patients with chronic heart failure (CHF), conditions characterized by sympathetic activation. We have examined the relationship between QTd and sympathetic activity in these two groups, using heart rate variability (HRV).

Methods: We evaluated 34 patients (7 ± 4) days after first AMI (59 ± 12 yrs; 28 M; 21 anterior; 24 Q-wave; 22 thrombolysed; mean LVEF 54 ± 8%) and 23 patients with stable CHF (67 ± 7 yrs; 20 M; LVEF 30 ± 8%). Patients were in sinus rhythm without bundle branch block. QTd was calculated from a 12-lead ECG by a single, blind observer. Autonomic tone was assessed by power spectral analysis of HRV from a short term (5-min) Holter recording. LF (nu), HF (nu) and LF/HF ratio were calculated. Results were analysed separately for each group.

Results: Mean QTd was (70 ± 25 ms) after AMI and (69 ± 31 ms) in CHF. QTd was unrelated to age, gender, LVEF or medications in each group but was significantly related to LF, HF and to LF/HF ratio. Correlations are given for AMI, followed by CHF. LF: ($R = +0.49$; $R = +0.56$, $p < 0.01$ for both), HF: ($R = -0.37$; $R = -0.45$, $p < 0.05$ for both) and LF/HF ratio ($R = +0.38$; $R = +0.51$, $p < 0.05$ for both).

Conclusions: This is the first report of a link between HRV and QTd. It suggests that in patients after AMI and in CHF, increased sympathetic activity may increase QTd and that vagal tone may reduce it.

1054-95 Is QT Dispersion Predictive of Mortality in Patients With Severe Congestive Heart Failure?

M.I. Anastasiou-Nana, J.N. Nanas, L.A. Karagounis, E. Tsagalou, N. Kouvelas, I. Tsolakis, S.F. Stamatelopoulos. *University of Athens, Athens, GR; University of Utah, Salt Lake City, UT, USA*

Background: There is increasing evidence that QT dispersion (QTd) is predictive of mortality in pts with chronic heart failure (CHF). However, data are lacking on the prognostic significance of QTd in patients (pts) with severe CHF. The study was thus, undertaken to prospectively investigate the relation between QTd and mortality on a group of 104 pts with severe CHF.

Methods: Study population consisted of 104 pts, mean age 53 ± 13 yrs, with mean ejection fraction (EF) 22 ± 10%. QT dispersion defined as the difference between maximum and minimum QT was calculated in ECGs in which at least 6 leads were measurable.

Results: The mean QTd and JT dispersion (JTd) were 82 ± 36 and 81 ± 39 msec, respectively. During the 22-mo mean follow-up period, 23 (22%) pts died, 10 suddenly. Factors associated with an adverse prognosis in univariate analysis were NYHA functional class ($p = 0.005$), JTd ($p = 0.005$), EF ($p = 0.03$) and QTd ($p = 0.03$). Multivariate associates of cardiac death using multivariate Cox proportional Hazard regression model were: NYHA functional class ($p = 0.0007$) and QTd ($p = 0.01$). QTd was a strong mortality predictor, with a 2.8-fold increase in mortality in pts with QTd > 90 msec compared with those pts with QTd < 90 msec (95% CI 1.2 to 6.4).

Conclusion: Our study based on a large patient population with severe CHF indicates that QTd provides a means of stratifying pts at increased risk of dying.

1054-96 Effect of Aging and Gender on QT Dispersion in an Overtly Healthy Population

J. Kassotis, C. Costeas, A. Tolat, J. Reiffel. *Columbia University, New York, New York, USA*

QT interval (QT) prolongation on the surface ECG is associated with arrhythmias and sudden cardiac death (A/SCD). QT dispersion (QT_d), a measure of variability in ventricular recovery time, also identifies risk for A/SCD. A long QT_d indirectly suggests underlying myocardial inhomogeneity. To interpret QT_d, normal values must be known. To date no study has looked adequately at age and gender differences in QT_d. We therefore studied the relationship between age, gender and QT_d in 246 apparently healthy subjects (118 women, 128 men, age range 20–86 years) with resting 12 lead ECGs. The heart rate (HR) and QT_d (difference between the maximum and minimum QT for all measurable leads) were calculated for each ECG. There was no association between aging and QT_d for either gender ($r = 0.04$ $-r = 0.031$, p = NS) but a significant difference was noted in QT_d between men (mean age 53.3 ± 15.6, QT_d 0.044 ± 0.019) and women (mean age 52.1 ± 15.1, QT_d 0.034 ± 0.015) $p < 0.001$. Men had a greater QT_d in all age groups, reaching statistical significance in most subsets.

Males			Females			p
Age (mean)	HR (mean)	QTd	Age (mean)	HR (mean)	QTd	
26.1	77.0	0.044	24.6	74.4	0.040	NS
34.9	70.1	0.038	34.5	71.0	0.027	0.02
44.7	71.4	0.048	44.0	74.4	0.034	0.03
55.2	68.1	0.047	54.9	72.1	0.034	0.007
65.7	71.8	0.044	64.5	71.5	0.040	NS
72.0	69.9	0.044	71.8	72.6	0.029	0.003
82.5	72.0	0.046	81.2	71.3	0.045	NS

We Conclude: (1) though QT increases with age, which is known from previous work, aging has no effect on QT_d; and (2) although women have longer QT than men, men have a greater QT_d. Prolonged QT_d may not account for the higher incidence of A/SCD in the elderly, but may be a factor in male dominance of A/SCD.

1054-97 Spontaneous Coronary Reperfusion During Acute Myocardial Infarction Is Associated With Reduced QTc Dispersion

A.W. Haider, L. Rallides, D. Tousoulis, G.J. Davies. *Cardiology Division RPMS Hammersmith Hospital London, UK*

Background: Recent reports suggest that preinfarction angina with associated intermittent episodes of ischaemia and reperfusion confers myocardial protection. QTc dispersion represents uniformity of ventricular repolarisation and when increased is predictive of increased mortality.

Methods and Results: We investigated the association between early spontaneous reperfusion (SR) during acute myocardial infarction (AMI) and QTc dispersion in 35 patients admitted within 6 hours of onset of symptoms. Holter ECG monitoring was started on admission and coronary angiography was performed 90 minutes after i.v. tissue plasminogen activator (rtPA). SR was defined as ≥22 episodes of resolution of elevated ST segment lasting 2 minutes, seen before start of rtPA. QTc dispersion was calculated from 12 lead ECG on hospital admission and 24 hours later. All patients received oral aspirin and i.v. Heparin. SR was documented in 16 patients (48%, Group 1) and was absent in 17 patients (52%, Group 2). Age, gender, previous AMI, symptom onset to rtPA time, peak Creatine Kinase levels and 90 minute patency of the infarct related coronary artery was similar in the two groups. For all patients, QTc (mean ± SD) was 60 ± 22 msec on hospital admission and 73.7 ± 25.6 msec ($p = 0.04$) at 24 hours. On admission, patients in Group 2 had greater QTc dispersion compared to those in Group 1 (72.5 ± 22.6 msec vs. 44.2 ± 17.2 msec, $p = 0.007$). At 24 hours, this trend persisted between the two patient groups (70.8 ± 24 msec vs. 63 ± 25 msec, $p = 0.6$).

Conclusions: Early spontaneous reperfusion at the onset of AMI is associated with reduced QTc dispersion. Ischaemic preconditioning may be a mechanism responsible for this protection.

1055 Triggers of Myocardial Infarction and Sudden Death

Monday, March 30, 1998, Noon–2:00 p.m.
Georgia World Congress Center, West Exhibit Hall Level
Presentation Hour: 1:00 p.m.–2:00 p.m.

1055-71 Infections Prior to Acute Myocardial Infarction Onset

Z.-J. Zheng, M.A. Mittleman, G.H. Tofler, C. Pomeroy, C. Dampier, B. Wides, J.E. Muller. *University of Kentucky, Lexington, KY; Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA*

Background: Increasing evidence now suggests a linkage between infection and the pathogenesis of atherosclerosis. Although most studies have focused on a chronic linkage, it is possible that an acute linkage may exist in which infection triggers the onset of myocardial infarction (MI).

Methods: We conducted an analysis of prior infection in the 2264 patient database of an NHLBI-sponsored study that has characterized triggering of MI by anger, physical exertion and sexual activity. Patients were interviewed within a week after the onset of MI by trained nurses using a standardized questionnaire. Patients were asked "During the week before your heart attack, did you have any flu-like illness with a fever and sore-throat, or any other infection?" and characteristics of the infection were identified.

Results: A total of 437 patients (19%) responded positively to the question above indicating a flu-like illness or other infection. Of these, 196 reported having had upper respiratory system symptoms, 49 had fever, 26 had gastrointestinal system symptoms, and 10 had urinary system infection. Sixty-two

MONDAY POSTER

percent of these patients reported that symptoms of infection started within one week prior to the MI onset. Using the case-crossover analysis, the odds ratio of MI for infections one day prior to MI onset was 2.4 (95% CI: 1.7–3.4), compared to the seventh day prior to the onset.

Conclusion: Although external control data are not available, the finding that 17% of patients in this large database report an infection in the week prior to MI onset is compatible with the possibility that infection triggers MI. This finding coincides with recent studies linking infection and inflammation to atherosclerosis, supports the need for controlled studies of infection as a trigger.

1055-72 Cocaine Use as a Trigger of Acute Myocardial Infarction

M.A. Mittleman, D. Mintzer, M. Maclure, G.H. Tofler, J.B. Sherwood, J.E. Muller. *Beth Israel Deaconess Medical Center, Boston, MA; University of Kentucky Medical Center, Lexington, KY, USA*

Although anecdotal reports indicate that cocaine use can trigger acute myocardial infarction (MI) onset, there have been no controlled studies of the magnitude of the increased risk, nor the duration of the hazard period. We therefore collected data in the Onset Study to rigorously evaluate this association.

Between August 1989 and September 1996 we interviewed 3,946 patients with acute MI at 45 medical centers across the United States. Patients were interviewed an average of 4 days following MI onset. A self-matched case-crossover approach was used to evaluate the relative risk of MI onset following cocaine use.

Of the 3,946 patients interviewed, 38 (0.9%) reported cocaine use in the year prior to the onset of MI, and 9 reported use within the 60 minutes before the onset of their MI symptoms. Cocaine users were more likely to be male (87% vs 67%, $p = 0.01$), younger (44 ± 8 vs 61 ± 13 years, $p < 0.001$) and non-white (61% vs 11%, $p < 0.001$) compared with non-users. The risk of MI onset was elevated 23.7 fold (95% CI, 8.5 to 66.2) in the 60 minutes following cocaine use and rapidly returned to baseline beyond the first hour.

Conclusion: Cocaine use is associated with a large abrupt increase in the risk of acute MI in subjects who are otherwise at relatively low risk. Drug education campaigns ought to include information regarding the magnitude of this risk. This finding also suggests that studying the pathophysiologic changes produced by cocaine may provide insights into the mechanisms of triggering.

1055-73 Difficult to Control Neurally Mediated Syncope: Is it Familial

R. Ashraf, N.N. Kadri, T.T. Hee, G.B. Schaefer, S.M. Mohiuddin. *Creighton University, Omaha, Nebraska*

Familial tendency in difficult to control (DTC) neurally mediated syncope (NMS) has been described in sporadic forms. However pattern of inheritance, if present, has not yet been identified. Therefore, the charts of 35 patients (pt's) with DTC-NMS who were enrolled in a clinical study were reviewed retrospectively. DTC-NMS is defined as a pt with recurrent NMS that occurs at least once monthly, has a positive head up tilt that reproduced symptoms, and unresponsive to conventional therapy. 26/35 available and consenting pts were contacted by telephone to inquire the detailed family history of such disorder. The pedigrees of kindreds were constructed and analyzed by a clinical geneticist (GS).

Results: 14/26 pts with syncope/presyncope (average of 10 episodes/month) failed conventional treatment and had a family history of such disorder were identified. Ten pts had no family history of DTC-NMS up to three generations. One pt died and the other was adopted. Two pts were related as mother and son. 13 pedigrees were constructed. There were 46 affected kindreds with nearly equal male to female ratio (22/24 respectively). 33/46 affected individuals were among first degree relatives. Male to male transmission was noted in one pedigree, suggesting that this is not an X-linked trait. There was one instance of an affected mother transmitting the condition to two sons with different fathers. Incomplete penetrance (transmissions of the trait from a non-affected obligate gene carrier) was noted in three pedigrees.

Conclusion: Genetic analysis of the pedigrees from 13 kindreds suggests autosomal dominant inheritance with incomplete penetrance in patients with DTC-NMS.

1055-74 Safety Baseballs Reduce Ventricular Fibrillation and EKG Changes in a Biological Model of Commotio Cordis, Sudden Death From Low Energy Chest Wall Impact

M.S. Link, P.J. Wang, N. Pandian, M.-Y. Lee, B. Vanderbrink, E. Avelar, B.J. Maron, N.A.M. Estes, III. *Tufts-New England Medical Center, Boston, MA, USA*

Background: Commotio cordis is sudden death resulting from a strike to the chest with a low energy object (typically a baseball). The etiology is thought to be ventricular fibrillation (VF). There is uncertainty about whether softer than standard (safety) baseballs will reduce the risk of sudden death in these young athletes.

Methods: In a juvenile swine model, VF could be reproducibly induced by 30 mph baseball strikes occurring 15 to 30 ms prior to the peak of the T-wave. We impacted 24 animals during this vulnerable period of the cardiac cycle with up to 3 strikes with either a standard baseball or a safety baseball (designed for players aged 5 to 7 years).

Results: Significantly fewer episodes of VF were seen in the animals impacted with a safety baseball ($p = 0.03$). In the 12 animals impacted with a safety ball there were 2 episodes of VF with 27 strikes. In the 12 animals impacted with a standard baseball there were 8 episodes of VF with 23 strikes. In addition, there were significantly fewer episodes of ST elevation, and bundle branch block with a safety ball.

	Standard ball	Safety ball	P-value
Ventricular Fibrillation	8/23 (35%)	2/27 (7%)	0.03
Heart block	3/15 (20%)	1/25 (4%)	0.10
ST elevation	8/15 (53%)	4/25 (16%)	0.03
Bundle branch block	4/15 (27%)	0/25 (0%)	0.03

Conclusion: Safety baseballs decrease the risk of ventricular fibrillation in a swine model of low energy chest wall impact. These findings emphasize potential methods of reducing sudden death in the young athlete.

1055-75 Is Preparticipation Screening for Cardiovascular Disease Adequate in United States High Schools?

D.W. Glover, B.J. Maron. *St. Luke's Hospital, Kansas City, MO; Minneapolis Heart Institute Foundation, Minneapolis, MN, USA*

Background: Sudden death in young student-athletes due to unsuspected cardiovascular (CV) disease has heightened public interest in preparticipation screening.

Methods: To understand the limitations of screening for detecting important CV lesions, 51 state high school jurisdictions were contacted to determine their guidelines for implementation of screening.

Results: Of the 51, 9 (18%) have no recommended history/physical questionnaire to guide examiners. Of the remaining 42 states, only 7 (17%) had adequate forms when measured against 1996 American Heart Association guidelines. History forms showed relevant items were present in ~60% e.g., prior heart disease, murmur, dyspnea/chest pain, familial heart disease, or prior sports exclusion. Physical exam forms also showed high omission rates: ~20% had murmurs, irregular rhythm, blood pressure, Marfan stigmata. All states recommend physicians perform screening; however, 16 permit nurses/physician assistants and 11 provide for chiropractors.

Conclusions: Athletic screening currently in place in U.S. high schools to detect CV disease: 1) is highly dependent on history/physical exam forms that are frequently abbreviated/inadequate; 2) is implemented by various health care workers with different levels of expertise; 3) is severely limited in its power to detect lethal CV lesions. These observations represent an impetus to change/optimize athletic screening process.

1055-76 Reducing Exercise-related Sudden Cardiac Death Rates Among Recruits by Prevention of Exertional Heat Illness

J.A. Kark, J.W. Gardner, F.T. Ward. *Howard University Hospital, Washington, DC; Uniformed Services University of the Health Sciences, Bethesda, MD, USA*

Background: Two thirds of exercise-related death (ERD) of recruits are without preexisting disease: one third unexplained sudden cardiac death (U-SCD) and one third fatal exertional heat illness (EHI). Speculating that unrecognized EHI might cause U-SCD, deaths might be prevented by adjusting exercise intensity, rest cycles, and water intake hourly to the on-site wet bulb globe temperature index.

Methods: To test the effect of this intervention, we enumerated recruits, surveyed training practices, determined etiology for 96 ERDs from autopsy protocols, clinical records, eyewitness accounts, toxicology, and